# [LEED Process]

1:

Ans.: B

A: The credit-by-credit tracker includes comments and actual credit language for each credit along with its up-to-the-minute review status.

B: The project timeline gives an overview of all the steps of the project's process via real-time snapshots.

C: Project team members have access to every single credit. There are no additional credit assignments.

D: The project checklist (LEED Scorecard) is the best way to stay on top of credits attempted, under review, and earned.

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2:

Ans.: B

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3:

Ans.: C

A: Regional priority credits are for regions, not for individual rating systems. Each region (zip code) has six regional priority credits.

B: Local code would not define what LEED rating system to select from.

C: LEED has a 40/60 rule to help project teams decide on a rating system:

- If a particular rating system is appropriate for 40% or less of a LEED project building or space, then that rating system should not be used.
- If a particular rating system is appropriate for 60% or more of a LEED project building or space, then that rating system should be used.
- Project teams with buildings and spaces that do not fall into the scenarios described in a) and b) must independently assess their situation and decide which rating system is most applicable.

D: Most of the time the certification costs will be the same for new construction projects.

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4:

Ans.: B, D, F

GBCI administers the LEED certification program, performing third-party technical reviews and verification of registered projects to determine if they have met the standards set forth by the LEED rating system.

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5:

Ans.: C

A: Prerequisites must also be met.

B: 'Satisfy relevant prerequisites' is not correct because project teams can't choose what prerequisites to meet for a given rating system. All prerequisites for the rating system the project will certify under must be followed. At least 40 points must be earned for a building to be LEED Certified at the base level (Certified).

C: After selecting a rating system a project must satisfy **all** prerequisites and earn a minimum number of points to be certified.

D: Green Raters are only relevant to the LEED BD+C: Homes rating system.

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6:

Ans.: D

-A LEED interpretation can be used for all projects certifying under the rating systems that it applies to, as indicated in the LEED Interpretations and Addenda database.

- A LEED interpretation is an opportunity to contribute to the LEED conversation in a significant way. This is in addition to opportunities such as commenting and voting during the new rating system creation process, suggesting addenda, volunteering on a USGBC committee, etc.

- LEED interpretations are not an avenue for making significant changes or new requirements to the LEED rating system. LEED interpretations are also not the intended path for fixing errors in the LEED rating systems and reference guides. USGBC publishes clarifications (also called addenda) to address those issues.

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7:

Ans.: B, D

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8:

Ans.: D

The Minimum Program Requirements are:
Minimum Program Requirement 1. Must be in a permanent location on existing land
Minimum Program Requirement 2. Must use reasonable LEED boundaries
Minimum Program Requirement 3. Must comply with project size requirements

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9:

Ans.: A

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10:

Ans.: B

-All formal inquiries first undergo the project CIR process. Project teams that want their formal inquiry to be considered for a LEED interpretation must opt in and pay for the LEED interpretation at the time they submit their inquiry.

-USGBC customer service can be used for technical issues, such as those that occur with the website.

11:

Ans.: B

-USGBC is responsible for administering and creating the LEED rating systems.

-USGBC issues LEED building certifications once they have been approved by GBCI's third-party review.

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12:

Ans.: C, E

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13:

Ans.: D

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14:

Ans.: B, D, E

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15:

Ans.: A, B

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16:

Ans.: A

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17:

Ans.: B

-The project administrator assigns credits to team members.

-Any team member can submit a CIR.

-The person filling out the registration form usually submits the project narrative.

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18:

Ans.: B

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19:

Ans.: C

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20:

Ans.: B

-LEED O+M projects have a performance period requirement where various building systems are measured over time.

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21:

Ans.: C

1. Precedent-setting
LEED Interpretations are to be used by any project certifying under an applicable rating system. All project teams are required to adhere to all LEED interpretations posted before their registration date. This also applies to other addenda. Adherence to rulings posted after a project registers is optional, but strongly encouraged.
A Project CIR can only be used by the project that submitted it.
2. Published Online
LEED interpretations will be published in a searchable database at usgbc.org. Project CIRs are not published publically.

3. Subject to consensus-based review
LEED interpretations undergo review by the US Green Building Council's (USGBC) member-selected volunteer LEED committees.
Project CIRs are created by the certification review teams at the Green Building Certification Institute (GBCI).

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22:

Ans.: A

In the commercial building rating systems the topics of Awareness and Education are covered under the Innovation category.

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23:

Ans.: C

LEED's system goals are referred to as 'Impact Categories.' Seven Impact Categories were developed and approved by the LEED Steering Committee for incorporation into LEED v4. These Impact Categories answer the question: 'What should a LEED project accomplish?'

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24:

Ans.: A

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25:

Ans.: C

-The LEED boundary is the portion of the project site submitted for LEED certification. (-USGBC)
For single building developments, this is the entire project scope and is generally limited to the site boundary - they are not necessarily the same thing.

In the case of a multiple building project the LEED boundary is that part of the entire project being submitted for certification as determined by the project team.

-The *property* boundary is the total area within the legal property boundaries of the site; it encompasses all areas of the site, including constructed and nonconstructed areas.

-The project boundary is the platted property line of the project defining land and water within it.

---

26:

Ans.: C

-USGBC's vision is that 'buildings and communities will regenerate and sustain the health and vitality of all life within a generation.'

---

27:

Ans.: C

- MPRs are the minimum characteristics or conditions that make a project appropriate to pursue LEED certification. These requirements are foundational to all LEED projects and define the types of buildings, spaces, and neighborhoods that the LEED rating system is designed to evaluate.

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28:

Ans.: B

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29:

Ans.: D

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30:

Ans.: B

- The development footprint is the total land area of a project site covered by buildings, streets, parking areas, and other typically impermeable surfaces constructed as part of the project.

- The building envelope (aka building shell) is the exterior surface of the building. It includes the walls, windows, roof, and floor.

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31:

Ans.: B, C

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32:

Ans.: D

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33:

Ans.: B

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34:

Ans.: A

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35:

Ans.: D

Licensed Professional Exemption (LPE) is an optional credit documentation path in which professionals can submit license information and a declaration of compliance in lieu of a number of otherwise required submittals.
Credit forms automatically recognize and link LP information from user account data when that user accesses the credit form. Licensed Professional (LP) Information must be identified from the My Account Page of the user's account, or during User Registration. This information is visible within a project on the Team Administration page, but can only be added or changed from the My Account

Page. For LPE paths with multiple sign-offs, more than one team member may be assigned to the credit or prerequisite for signatures. (see 'Assign Credits') Note: It is not required that the LP be a LEED AP. Also, the LP must have a U.S. license but it does not have to be issued from the state of the project.
Based on credit, LPE streamlined paths are available to:
Professional Engineers (PE)
Registered Architects (RA)
Registered Landscape Architects (RLA)
Registered Interior Designers (RID)

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36:

Ans.: D

The Build a Greener Economy impact category components are:
Enhance the Value Proposition of Green Building
Strengthen the Green Building Industry and Supply Chain
Promote Innovation and Integration of Green Building Products and Services
Incentivize Long Term Growth and Investment Opportunities
Support Local Economies

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37:

Ans.: B

Each rating system will have its own set of forms that must be completed and submitted for documentation and verification. These credit forms accessed via LEED Online.
Credits/prerequisites are assigned by the project administrator. Whoever has been assigned responsibility for the credit/prerequisite by the administrator fills out the credit form using LEED Online. Once all of the credit forms are completed for those credits being attempted, the project administrator will submit the project for review.
The credit forms are also referred to as credit templates, submittal templates, or submittals.

The LEED Credit Checklist helps project teams track their credits against requirements for certification. The LEED Credit Checklist is also called the *LEED Scorecard*.

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38:

Ans.: B

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39:

Ans.: B

What is consensus in LEED?
LEED is developed by USGBC member-based volunteer committees, subcommittees, and working groups in conjunction with staff. LEED development follows a structure that includes a balanced representation of stakeholders and management of conflict of interest, to ensure that the development of LEED is transparent and consensus-based. The LEED committee structure balances market needs and constraints with consistency and technical rigor in the development and improvement of the credits within LEED, to ensure the quality and integrity of the LEED brand. The balloting process of new versions with USGBC membership reinforces the open consensus process. The appeal procedures that are implemented by USGBC further support the consensus process and ensure the fair treatment of affected stakeholders. All of these measures are essential to protecting and enhancing the integrity, authority, and value of LEED.

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40:

Ans.: C

-Under the direct management of the LEED Technical Committee, Technical Advisory Groups (TAGs) recommend technical solutions to rating system development and maintenance issues. The groups provide a consistent source of technical advice to LEED committees and working groups regarding credit and prerequisite improvement and supporting tool development. Technical Advisory Groups are structured to include expertise for specific technical issues: location and planning, sustainable

sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.

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41:

Ans.: A, B, C

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42:

Ans.: C

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43:

Ans.: D

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44:

Ans.: A

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45:

Ans.: B

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46:

Ans.: D

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47:

Ans.: A, C, D

48:

Ans.: A

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49:

Ans.: C

-The project boundary is the platted property line of the project defining land and water within it. It is used to define the construction area.

-The LEED boundary is the portion of the project site submitted for LEED certification.

-The property boundary and/or property area is the total area within the legal property boundaries of the site; it encompasses all areas of the site, including constructed and nonconstructed areas.

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50:

Ans.: D

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51:

Ans.: B

- The LEED Technical Committee oversees Technical Advisory Groups (TAGs) and other technical working groups and recommends solutions regarding technical issues to the LEED Steering Committee. Its responsibilities include coordinating cross-category matters within LEED, reviewing LEED credits and prerequisites for technical validity and recommending improvements, and assessing LEED's technical rigor, coherency, and achievement trends through a system of performance metrics.

- The LEED Steering Committee (LSC) is an integrated group of volunteers and staff charged with developing and maintaining LEED as a leadership tool, preserving the integrity of the LEED rating systems, and ensuring the use of the consensus process to evolve LEED in accordance with the mission, guiding principles, and strategic plan of USGBC. A standing committee of USGBC Board of Directors, the LEED Steering Committee is the governing body of all LEED committees.

- USGBC Board of Directors articulates and upholds the vision, values, and mission of USGBC. Directors meet in person three times each year and by teleconference regularly throughout the year.

- Under the direct management of the LEED Technical Committee, Technical Advisory Groups (TAGs) recommend technical solutions to rating system development and maintenance issues. The groups provide a consistent source of technical advice to LEED committees and working groups regarding credit and prerequisite improvement and supporting tool development. Technical Advisory Groups are structured to include expertise for specific technical issues: location and planning, sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.

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52:

Ans.: A

A:

These Impact Categories answer the question: 'What should a LEED project accomplish?':
Reverse Contribution to Global Climate Change
Enhance Individual Human Health and Well-Being
Protect and Restore Water Resources
Protect, Enhance and Restore Biodiversity and Ecosystem Services
Promote Sustainable and Regenerative Material Resources Cycles
Build a Greener Economy
Enhance Social Equity, Environmental Justice, and Community Quality of Life

B:

These two choices are components of impact categories.
Reuse Dependence on Fossil Fuels is component of Reverse Contribution to Global Climate Change.
Create a Strong Sense of Place is a component of Enhance Social Equity, Environmental Justice, Community Health and Quality of Life.

C:

These are the factors of Location.

D:

This are alternative terms for People, Planet, Profit of the triple bottom line.

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53:

Ans.: A, C, E.

There are three basic types of LEED improvements:
-Implementation and maintenance of the current version of LEED: This process includes the correction and clarification of credit language as well as fixing more substantive inaccuracies and omissions, which require a more rigorous review and approval process.
-Adaptations: The process for adaptations to existing ratings systems and their credits provides an efficient and streamlined approach for responding to the particular needs, constraints and opportunities of different project types.
-Next version: This is the comprehensive improvement phase of LEED development that occurs through a periodic evaluation and revision process. This phase includes multiple avenues for stakeholder input and final approval by USGBC members.

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54:

Ans.: D

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55:

Ans.: A, D

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56:

Ans.: B

USGBC has seven guiding principles outlined in the 2013-2015 strategic plan.
They are:

-PROMOTE THE TRIPLE BOTTOM LINE - USGBC will pursue robust triple bottom line solutions (people, planet, profit) that clarify and strengthen a healthy and dynamic balance between environmental, social, and economic prosperity.
-ESTABLISH LEADERSHIP - USGBC will foster both revolutionary and evolutionary leadership by championing societal models that achieve a more robust triple bottom line.
-RECONCILE HUMANITY WITH NATURE - USGBC will endeavor to create and restore harmony between human activities and natural systems.
-FOSTER SOCIAL EQUITY - USGBC will continue to respect all communities and cultures and aspire to be a fully inclusive movement that embraces opportunities which broaden and expand our reach through partnerships and initiatives.
-MAINTAIN INTEGRITY - USGBC will be guided by the precautionary principle in utilizing technical and scientific data to protect, preserve and restore the health of the global environment, ecosystems, and species.
-BE INCLUSIVE - USGBC will ensure inclusive, interdisciplinary, multi-sector, and democratic decision making with the objective of building understanding and shared commitments toward a greater common good. In this spirit, USGBC will continue to seek common ground and partner with allied, influential organizations and leaders in the field to confront mutual challenges.
-EXHIBIT TRANSPARENCY - USGBC will continue to operate in an organizational culture that places honesty, openness, and transparency above all else

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57:

Ans.: B

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58:

Ans.: C

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59:

Ans.: A

60:

Ans.: C

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61:

Ans.: A

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62:

Ans.: D

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63:

Ans.: D

- Location and transportation credits reward projects within relatively dense areas, near diverse uses, with access to a variety of transportation options, or on sites with development constraints.

- Regional priority credits address regional environmental priorities for buildings in different geographic regions.

- Water efficiency credits promote smarter use of water, inside and out, to reduce potable water consumption.

- Sustainable sites credits encourage strategies that minimize the impact on ecosystems and water resources.

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64:

Ans.: A

The IgCC provides the building industry with language that both broadens and strengthens building codes in a way that will accelerate the construction of high performance green buildings.

Jurisdictions that adopt the IgCC into their building codes can enforce them.

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65:

Ans.: F

Weighting of the LEED v4 impact categories account for differences in scale, scope, severity, and relative contribution of the built environment to the impact. The weightings are:

35% Reverse Contribution to Global Climate Change
20% Enhance Individual Human Health and Well-Being
15% Protect and Restore Water Resources
10% Protect, Enhance and Restore Biodiversity and Ecosystem Services
10% Promote Sustainable and Regenerative Material Resources Cycles
5% Build a Greener Economy
5% Enhance Social Equity, Environmental Justice, Community Health and Quality of Life

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66:

Ans.: C

Once a project is registered as a LEED BD+C: Core and Shell project, the project team may apply for precertification. LEED BD+C: Core and Shell precertification is a formal recognition by the USGBC given to a candidate project for which the developer/owner has established a goal to develop a LEED BD+C: Core and Shell building. Once precertification is granted, the developer/owner can market the building's proposed green features to potential tenants and financiers.

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67:

Ans.: C

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68:

Ans.: D

The components of the Protect, Enhance and Restore Biodiversity and Ecosystem Services are:
Local Biodiversity, Habitat Protection and Open Spaces
Global Biodiversity, Habitat Protection and Land Preservation
Sustainable Use and Management of Ecosystem Services

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69:

Ans.: D

CIRs are used for technical guidance on credits. Anyone on the project team can submit a CIR, as long as the person has access to LEED Online (through the project administrator). Once a CIR is submitted a payment must be made to GBCI in order for GBCI to review the CIR.
A CIR can be used for administrative inquiries, although doing so is rare.
Inquiries must request guidance on just *one credit or prerequisite* (unless there is technical justification to do otherwise) and generally contain one concise question or a set of related questions. It is often helpful to discuss the inquiry within context of the credit's intent.

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70:

Ans.: A

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71:

Ans.: A

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72:

Ans.: C

-For LEED BD+C: Homes and Multifamily Lowrise is used for single-family homes and multi-family residential buildings of one to three stories.
-Projects three to five stories may choose the homes rating system that corresponds to the ENERGY STAR program in which they are participating.

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73:

Ans.: C

A: LEED Online.

B: The LEED Rating System adaptations, LEED BD+C: New Construction rating system currently has the following adaptations:

LEED BD+C: Core and Shell
LEED BD+C: Schools
LEED BD+C: Retail
LEED BD+C: Data Centers
LEED BD+C: Warehouses
LEED BD+C: Hospitality
LEED BD+C: Healthcare

C: The LEED Pilot Credit Library facilitates the introduction of new prerequisites and credits to LEED. The process allows projects to test credits that haven't been through USGBC's complete drafting and balloting process.

D: This is the purpose of LEED Interpretations.

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74:

Ans.: D

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75:

Ans.: B

76:

Ans.: D

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77:

Ans.: D

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78:

Ans.: B

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79:

Ans.: B

The components of the impact category Protect, Enhance and Restore Biodiversity and Ecosystem Services are:
Local Biodiversity, Habitat Protection and Open Spaces
Global Biodiversity, Habitat Protection and Land Preservation
Sustainable Use and Management of Ecosystem Services
By increasing open space the project could earn a LEED credit for increasing open space.

---

80:

Ans.: D

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81:

Ans.: D

The square footage of the project is the primary cost consideration for LEED-certification.
Remember certification and registration fees are not the same.

82:

Ans.: D

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83:

Ans.: D

The 5 components of this impact category are:
-GHG Emissions Reduction from Transportation Energy Use
-GHG Emissions Reduction from Materials and Water Embodied Energy Use
-GHG Emissions Reduction by Embodied Energy of Water Reduction
-GHG Emissions Reduction from a Cleaner Energy Supply
-Global Warming Potential Reduction from Non-Energy Related Drivers

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84:

Ans.: C

A mixed use project for new construction would use the LEED BD+C: New Construction rating system.

LEED BD+C: Retail would not be applicable because the project includes retail and residential space.

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85:

Ans.: B

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86:

Ans.: B

An addition to the technical content of the IgCC is the inclusion of ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High Performance, Green Buildings Except Low-Rise Residential Buildings, as an alternate path of compliance. Standard 189.1 is a set of technically rigorous

requirements, which like the IgCC, covers criteria including water use efficiency, indoor environmental quality, energy efficiency, materials and resource use, and the building's impact on its site and its community.

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87:

Ans.: A

USGBC Name: The official organization name is the U.S. Green Building Council. 'USGBC' is the official acronym. Use the complete name for any first reference. Subsequent references in copy may use USGBC. NOTE: When using 'USGBC' as a noun, do not precede with 'the.' For example: Contact USGBC for more information.

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88:

Ans.: D

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89:

Ans.: C

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90:

Ans.:C

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91:

Ans.:C

A: This is part of USGBC's mission.

B: This is CaGBC's vision.

D: This is CaGBC's mission guide.

92:

Ans.: D

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93:

Ans.: A, B.

---

94:

Ans.: C

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95:

Ans.: B

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96:

Ans.: B

Support Occupant Comfort and Well-Being is a component of the impact category Enhance Individual Human Health and Well-Being.

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97:

Ans.: D

For LEED BD+C: Data Centers to be applicable the size of the data center in relation to the building must be 60% or more. In this case it is only the bottom three floors, which would be just 30%

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98:

Ans.: A

- The LEED Volume Program is a streamlined certification process for organizations planning to certify a large number of new construction projects that are prototype-based.

- The Campus Program, in contrast to the LEED Volume Program, is for projects not necessarily uniform in design or operations but located on a single campus location.

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99:

Ans.: D

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100:

Ans.: A

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101:

Ans.: A

- prerequisite refers to a mandatory project characteristic, measurement, quality, value or function as identified within the LEED rating system.

- MPR define the types of buildings that the LEED Green Building Rating Systems were designed to evaluate, and taken together serve three goals:

1. to give clear guidance to customers
2. to protect the integrity of the LEED program
3. and to reduce complications that occur during the LEED Certification process

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102:

Ans.: D

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103:

Ans.: A, D, E.

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104:

Ans.: B

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105:

Ans.: C

The USGBC LEED Steering Committees determine the credit weighting based on a point allocation methodology.
The basic approach is that each of the LEED credits are independently evaluated along each of the seven impact categories, in a matrix style format with credits as rows, impact categories as columns, and associations between credits and impact categories as individual cells. For each cell, an association between credit and impact category is determined and given a weight that depends on the relative strength of that association (i.e. credit outcome weighting).

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106:

Ans.: A, D

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107:

Ans.: C

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108:

Ans.: D

# [Integrative Strategies]

1:

Ans.: D

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2:

Ans.: D

A: This is an example of a team meeting.

B:  This is an example of a small task group meeting.

C: This is a charrette. Also included in the charrette are any external experts that might be needed for consultation.

D: This is an example of a stakeholder meeting. Stakeholders involve everyone that may be impacted by the project.

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3:

Ans.: A

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4:

Ans.: B

- When materials are released outside the system the system is considered open.

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5:

Ans.: A, C

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6:

Ans.: A, B

7:

Ans.: C

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8:

Ans.: A

---

9:

Ans.: D

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10:

Ans.: A

For some LEED rating systems, the design charrette is part of the requirement for prerequisite/credit. In those cases, no later than the design development phase and preferably during schematic design, conduct at least one full-day workshop (or two half-day workshops) with the project team.

---

11:

Ans.: D

A: The integrative process focuses on the project goals, which the team members come up with.

B: The integrative process uses life cycle costing and life cycle analysis to make decisions rather than first costs.

C: Linear planning is how conventional building is done.

D: Integrative projects are based on integrative teams and frequent, collaborative communications.

---

12:

Ans.: A

The ISO 14000 product oriented standards include Environmental Labels and Declaration, Life Cycle Assessment, and Design for Environment. These standards are intended to be applicable for assessing the environmental performance of products and services as well as providing guidance on improving their environmental performance.
The ISO 14021 series standards, Environmental Labels and Declaration, are communication tools that convey information on environmental aspects of a product or service to the market.
These standards are used for recycled materials to label their pre and/or post consumer content.

---

13:

Ans.: D

A: The integrative process continues until the building's end-of-life - not at project handover.

D: Metrics and measuring for success are part of the integrative process.

---

14:

Ans.: A

- A negative synergy with a tight building envelope is the air inside becomes stagnant. Fresh air and increased ventilation needs to be brought in to improve air quality. However by increasing ventilation more energy is needed.

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15:

Ans.: A

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16:

Ans.: A

A declarant is 'A LEED project team member who is technically qualified to verify the content of a LEED credit submittal template, and is authorized by the project administrator to sign the template and upload it to LEED Online. The Declarant must have had a significant degree of responsibility for the credit, i.e., participation with and/or oversight of either implementing the credit in the project building or of verifying its outcome.' (USGBC)
The declarant is the person who will sign a submittal template. Each template can have a different declarant.
Each rating system will have its own set of forms that must be completed and submitted for documentation and verification. These forms are called submittals or credit templates, and are accessed with LEED Online.
The project administrator assigns credits/prerequisites to individuals (declarants) to complete.

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17:

Ans.: B

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18:

Ans.: C

-For any projects outside the U.S., the ISO standard developed by the Global Eco-Labeling Network may be used instead of Green Seal Environmental Choice.

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19:

Ans.: B

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20:

Ans.: C

A: This happens when construction documents are created.

B: In this step a person is assigned responsibility for documenting and signing each credit.

C: Before any design work meet with the building owner to determine their goals for the project.

D: This step is part of determining synergies between credits.

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21:

Ans.: D

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22:

Ans.: B

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23:

Ans.: D

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24:

Ans.: B

-ENERGY STAR for Homes is the basis of the requirements for energy efficiency in a LEED Homes project.

-ASHRAE 90.1 is used to measure minimum energy performance for commercial projects.

---

25:

Ans.: B, C

A: This occurs during design development.

B: The pre-design phase is the point when the project schedule is developed.

C: Reviewing laws and standards should be done as early as possible in the process since these have a significant impact on what can be built, where, and how.

D: This is part of the construction phase.

---

26:

Ans.: B

A: This describes the conventional building process during which people work on their own areas of expertise without consideration of the building as a whole.

B: Success in LEED and green building design is best accomplished through an integrative design process that prioritizes cost-effectiveness over both the short and long terms and engages all project team members in discovering beneficial interrelationships and synergies between systems and components.

C: The design schedules tend to be longer with LEED projects, but the construction schedules are shorter due to less mistakes because things were not forgotten or left out of the design.

D: For success, the various disciplines of the project team must come together to share their knowledge, analysis, and ideas to create synergies with the components and systems on which other team members are working.

---

27:

Ans.: A

B: The owner usually does this (with assistance from the team).

C: The energy modeler creates the model, not the whole team.

D: This would be done by the owner.

---

28:

Ans.: A, D

Some of the obstacles teams face with people new to green building include:
The costs and time to hold meetings
Resistance to green goals
Resistance to the integrative process
Not being familiar with the approaches suggested
Getting people to use the modeling tools

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29:

Ans.: A

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30:

Ans.: C

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31:

Ans.: C

– A charrette is an intense collaborative session where participants make a concerted effort to solve a problem or plan the design of something.
The charrette is one of the first things that should occur on a new project. During the initial charrette the project team will:

- Decide what rating system to use
- Determine the projects green building goals
- Set a preliminary rating using the LEED Project Checklist
  A charrette should be held no later than the design development phase and preferably during schematic design.

32:

Ans.: C

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33:

Ans.: A

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34:

Ans.: D

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35:

Ans.: C

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36:

Ans.: C

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37:

Ans.: B

- Systems thinking is a process of understanding how each part of the built environment affects every other part. It is the belief that the component parts of a system can best be understood in the context of relationships with each other and with other systems, rather than in isolation. These parts include project materials, building systems, site, people, and information.

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38:

Ans.: B, D, E

B: USGBC defines Implementation as, 'This phase begins with what is conventionally called 'Schematic Design.' It resembles conventional practice in its structure, but integrates all of the work and collective understanding of system interactions reached during the Discovery Phase

C: Value Engineering is a formal review process of the design of a project based on its intended function in order to identify potential alternatives that reduce costs and improve performance.

D: USGBC defines discovery as, 'This is the most important phase of the integrative process; it can be thought of as an extensive expansion of what is conventionally called 'Pre-Design.' It is unlikely that a project's environmental goals will be achieved cost-effectively if this phase is not rigorously engaged as a discreet phase of the design process. Discovery work needs to be accomplished before 'putting pencil to paper' . . . in other words, before schematic design begins

E: USGBC defines this stage as, 'This third stage focuses on implementing performance measurement and creating performance feedback mechanisms. Such feedback is critical for informing building operations, so the degree to which established performance targets have been met can be assessed and so corrective actions can be taken.

---

39:

Ans.: A

- The integrative process is, 'An iterative, collaborative approach that involves a project's stakeholders in the process from visioning through completion of construction and throughout building operation.'

- Integrative design continues throughout the building's operational lifetime and has no completion date.

---

40:

Ans.: A

- The Home Energy Rating System (HERS) Index is a standard by which a home's energy efficiency is measured.
Based on the results, an energy-rated home will receive a HERS Index Score. The HERS Index Score can be described as a type of miles-per-gallon (MPG) sticker for houses, giving prospective buyers and homeowners an insight as to how the home ranks in terms of energy efficiency. In addition to a HERS Index Score, a home-energy rating also provides the homeowner with a detailed report regarding energy problems in the house.

---

41:

Ans.: C

---

42:

Ans.: B, C, D

A: A closed system with a closed loop is thought of as more sustainable. For example, plants growing in a field, grow, produce oxygen, take in water, then die and decay which helps plants grow. Closed systems can be linked so one system uses the byproducts of another.

B: The integrative process is the approach of having separate stakeholders or designers work together to ensure the project is benefiting from synergy which allows for greater levels of sustainability throughout the project's life.

C: A life cycle approach considers all stages of a project, product or service. For example a life cycle approach for materials would consider growing raw materials and production, to distribution, consumer use and product disposal.

D: Systems thinking is a process of understanding how each part of the built environment affects every other part. It is the belief that the component parts of a system can best be understood in the

context of relationships with each other and with other systems, rather than in isolation. These parts include project materials, building systems, site, people, and information.

E: This is the traditional building approach. The opposite would be the integrative process.

---

43:

Ans.: D

- The purpose (or intent) of having a LEED AP on the project is to 'support and encourage the design integration required by LEED to streamline the application and certification process'.

- Any project team member can submit project data.

- The project administrator does not have to be a LEED AP.

---

44:

Ans.: C

---

45:

Ans.: A

---

46:

Ans.: D

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47:

Ans.: D

A: This is a positive feedback loop.

B: This is a positive feedback loop.

C: This is a positive feedback loop.

D: A negative feedback loop is a system where the output may signal the system to stop changing. Here the thermostat tells the system to stop running if a certain temperature threshold is reached.

---

48:

Ans.: C

---

49:

Ans.: B

---

50:

Ans.: B

A: This describes Regenerative Design.

B: This is USGBC's definition of systems thinking.

C: This describes Value Engineering.

D: This describes the integrative process.

---

51:

Ans.: A

---

52:

Ans.: B

---

53:

Ans.: D

- Site selection impacts a building's performance more than any other decision. Density, diverse uses, access to public transportation, daylighting strategies, rainwater management, etc. are all impacted by the location of the site

---

54:

Ans.: B

A: This is part of the integrative process, but not the definition of the charrette.

C: This is an example of trades training under LEED Homes.

D: This is part of the Occupation phase.

---

55:

Ans.: A

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# [Location and Transportation]

1:

Ans.: C

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2:

Ans.: C

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3:

Ans.: C, D

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4:

Ans.: B

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5:

Ans.: B

-The high-priority site credit helps project teams identify priority development areas. LEED projects can earn points for building in what tend to be disadvantaged neighborhoods.

---

6:

Ans.: D

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7:

Ans.: A

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8:

Ans.: C, D, E.

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9:

Ans.: B

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10:

Ans.: A, C.

-A diverse use is a distinct, officially recognized business, nonprofit, civic, religious, or governmental organization, or dwelling units (residential use) or offices (commercial office use). It has a stationary postal address and is publicly available. It does not include automated facilities such as ATMs, vending machines, and touchscreens.
There are five categories of use types:
Food retail
Community-serving retail
Services
Civic and community facilities
Community anchor uses

---

11:

Ans.: A, D

- Project teams that select to build in a LEED-ND neighborhood are choosing a site that has connection with the surrounding community and both a good location and transportation attributes already. LEED projects can earn credit for locating the project in a LEED-ND neighborhood.

- By locating a project in a LEED-ND location, the LT credits are streamlined because the LEED-ND project already has all of the necessary documentation for the LT credits; therefore the certification process is easier.

12:

Ans.: C

---

13:

Ans.: A

- High priority sites include:
  Historic districts
  Priority designation sites (Federal Empowerment Zones, EPA National Priorities List, etc.)
  Brownfield

---

14:

Ans.: A

---

15:

Ans.: B

---

16:

Ans.: C

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17:

Ans.: A

---

18:

Ans.: C

---

19:

Ans.: B

---

20:

Ans.: D

-Transportation demand strategies that can reduce single-occupancy vehicle use include:
Locating a project near public transportation
Encouraging carpooling
Encouraging walking or bicycling
Providing preferred parking for green vehicles
Discounted transportation passes for buses, rails, ferry's, etc.
Telecommuting
Compressed workweeks

---

21:

Ans.: B

- One of the synergies with parking reduction is that the land now not being used for parking is being protected from development, reducing the environmental impact from the location of a building on a site.

---

22:

Ans.: C

-Project teams that select to build in a LEED-ND neighborhood are choosing a site that has connection with the surrounding community and good location and transportation attributes already.

---

23:

Ans.: A

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24:

Ans.: C

-A diverse use is 'a distinct, officially recognize business, nonprofit, civic, religious, or governmental organization, or dwelling units (residential use) or offices (commercial office use). It has a stationary postal address and is publicly available. It does not include automated facilities such as ATMs, vending machines, and touchscreens.

---

25:

Ans.: A, C

-Infill development occurs within established urban areas where the site or area either is a vacant place between other developments or has previously been used for another urban purpose.

---

26:

Ans.: C

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27:

Ans.: C, D

A: Arborists certified by ISA can determine tree conditions on a site.

B: This defines prime farmland.

C: People from this agency can assist with determining sensitive habitats on land.

D: People from this agency can assist with determining sensitive habitats on land.

---

28:

Ans.: D

---

29:

Ans.: A

C: Locating the project near public parking may reduce the project's parking needs but this is not the best answer choice.

D: Parkland is open space (though not for the project) and should be avoided for building on.

---

30:

Ans.: B

-When calculating the walking distance for credits such as Diverse Uses, a walkable route is used for the measurement. LEED 2009 used a radius to calculate the distance, but this did not accurately determine pedestrian access.

---

31:

Ans.: B

- LT focuses on the surrounding community of the project and what currently exists - is there public transportation, existing infrastructure, a previously developed site to build on, etc.

---

32:

Ans.: D

-A diverse use is a distinct, officially recognized business, nonprofit, civic, religious, or governmental organization, or dwelling units (residential use) or offices (commercial office use). It has a stationary postal address and is publicly available. It does not include automated facilities such as ATMs, vending machines, and touchscreens.

---

33:

Ans.: A, D

---

34:

Ans.: D

---

35:

Ans.: B

---

36:

Ans.: B

-The development density of the project depends on the building design, not the type of land chosen.

---

37:

Ans.: A, D

---

38:

Ans.: B

---

39:

Ans.: A

---

40:

Ans.: D

- While locating the project near existing infrastructure reduces the strain on the environment, LEED does not award points for a strategy such as locating a project close to existing power or sewer lines.

---

41:

Ans.: D

A: This helps with the human element of the triple bottom line but having a diverse neighborhood does not promote connectivity.

B: Cul-de-sacs are dead ends that don't connect to anything.

C: Gated communities block people from moving freely through the community to get to the other side, hindering walkability.

D: A street pattern is how the streets are laid out. A street-grid pattern is one in which streets are laid out in squares/rectangles. Consider a city center that has blocks and how quickly individuals can get around compared to a suburban area in which the streets are not designed in a grid.

-Connectivity (walkability) is the ability for people to get from place to place easily without using automobiles. It encourages walking by making it easier for people to get around.
When developing communities focus on creating sustainable sites, this includes designing walkable

streets, promoting connectivity by using a street-grid pattern, providing diverse land uses that include a mix of services (such as shops and restaurants), and creating a diverse community by providing housing types for a wide range of incomes and promoting alternative transportation.

---

42:

Ans.: B

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43:

Ans.: B

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44:

Ans.: A,D

-What are you going to find in any downtown / city center? Sidewalks and diverse uses. Sidewalks promote walking, and diverse uses give people somewhere to walk.

-Locating a project near a bicycle network provides an opportunity for people to bike to work.

-Employee health is going to primarily addressed in two categories:
Indoor Environmental Quality - indoor health.
Location and Transportation - outdoor strategies that encourage physical activity.

---

45:

Ans.: B

A: A radius is not how bicycle networks are documented.

B: This is how the credit is documented.

C: This is how access to quality transit is documented.

D: A radius is not how bicycle networks are documented. This choice has parts of how density would be calculated.

# [Sustainable Sites]

1:

Ans.: B, D

Projects in an urban site with a zero lot line (the building footprint is on the site limit) will have to use green infrastructure (GI) and low-impact development (LID) rainwater management strategies since there is no land.
Low-impact development (LID) is 'an approach to managing rainwater runoff that emphasizes on-site natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles (e.g., minimizing land disturbance, preserving vegetation, minimizing impervious cover) and design practices (e.g., rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, soil amendments). These are engineered practices that may require specialized design assistance.'
Green infrastructure is 'a soil- and vegetation-based approach to wet-weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies.'

---

2:

Ans.: A, D

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3:

Ans.: C

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4:

Ans.: A, B

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5:

Ans.: D

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6:

Ans.: A

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7:

Ans.: D

-Vegetated roofs are great insulators. They act as a barrier between the sun's heat and keep that heat from entering the building through the roof. Because of this added insulation the costs to cool the building can be reduced.

-Vegetated roofs will have a higher upfront cost compared to a roof that has a EPDM covering or paint applied to it.

---

8:

Ans.: C

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9:

Ans.: A, B

- Open grid pavement is pavement that is less than 50% impervious and contains vegetation in the open cells. LEED accepts this type of pavement for the use of reducing heat islands. The reason behind this is because the vegetation in the open cells replaces heat absorbing surfaces just like any other plant.

---

10:

Ans.: B

A: Urban developments usually have access to previously *developed* land. It is in suburban areas where a project is more likely to find a greenfield to develop on.

B: The heat island effect refers to the ability of dark, non-reflective paved areas-city streets, rooftops, and sidewalks-to absorb and radiate heat, making urban areas and the surrounding suburbs noticeably hotter than rural towns nearby.

---

11:

Ans.: B

- Green infrastructure is 'a soil- and vegetation-based approach to wet-weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies.

- Low-impact development is 'an approach to managing rainwater runoff that emphasizes on-site natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles (e.g., minimizing land disturbance, preserving vegetation, minimizing impervious cover) and design practices (e.g., rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, soil amendments). These are engineered practices that may require specialized design assistance.

---

12:

Ans.: B

---

13:

Ans.: C

- The emissivity of a material is the ratio of energy radiated by a particular material to energy radiated by a black body at the same temperature. It is a measure of a material's ability to radiate absorbed energy.

---

14:

Ans.: D

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15:

Ans.: D

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16:

Ans.: B

-Light pollution is 'waste light from building sites that produces glare, is directed upward to the sky, or is directed off the site. Waste light does not increase nighttime safety, utility, or security and needlessly consumes energy.'
-Light pollution also negatively impacts animals that are nocturnal. There are several strategies to reduce light trespass from a site:
Design to prevent avoid over-lighting
Avoid up-lighting
Reduce glare
Direct full cutoff fixtures downward
Reduce the contrast between light and dark areas
Use shielded fixtures

---

17:

Ans.: C

A soccer field would have turf grass on it.

Monocultures are a single species of plant such as turf grass. Monocultures do not promote biodiversity.

---

18:

Ans.: C

Site assessment is one of the most important parts of the integrative process and informs good design decisions.
The site assessment influences over a dozen other LEED credit areas, some directly and others indirectly.
For example:
Access to Quality Transit
Surrounding Density and Diverse Uses
Sensitive Land Protection
Bicycle Facilities
Open Space
Rainwater Management
Heat Island Reduction
Energy Performance
Daylight
Quality Views
Renewable Energy Production

---

19:

Ans.: C, D

---

20:

Ans.: B

---

21:

Ans.:  D, E

---

22:

Ans.: C

---

23:

Ans.: D

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24:

Ans.: A, D

Solar Reflectance Index (SRI) indicates a material's ability to reject solar heat and is the combined value of reflectivity and emittance. Measurements vary from 100 (standard white surface, most reflective) to 0 (standard black surface, least reflective). Materials with the highest SRI values are the coolest choices for paving.
The higher the SRI number the more the sunlight the material can reflect. Black asphalt has an SRI of 0.

---

25:

Ans.: B

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26:

Ans.: B

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27:

Ans.: A, E

---

28:

Ans.: D, E.

-Evapotranspiration is the combination of evaporation and plant transpiration into the atmosphere. Evaporation occurs when liquid water from soil, plant surfaces, or water bodies becomes vapor.

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29:

Ans.: B, C, D

- A site assessment is 'an evaluation of an area's above ground and subsurface characteristics, including its structures, geology, and hydrology. Site assessments typically help determine whether contamination has occurred and the extent and concentration of any release of pollutants. Remediation decisions rely on information generated during site assessments.

---

30:

Ans.: A

---

31:

Ans.: C

32:

Ans.: B, D

-The primary cause of the heat island effect is dark surfaces such as rooftops or dark asphalt pavement that absorb heat and radiate it into the surrounding areas.
Reduced airflow between buildings and narrow streets also increases the effect.

---

33:

Ans.: A

Bioswales are landscape elements designed to remove silt and pollution from surface runoff water during and after construction. They consist of a swaled drainage course with gently sloped sides and filled with vegetation, compost and/or riprap.
Bioswales would be used to help capture and improve the quality of runoff.

---

34:

Ans.: D

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35:

Ans.: A, B, F

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36:

Ans.: A

New in LEED v4 is the three-year aged SRI value as a performance measurement of roofing/hardscape materials. The three-year aged SR or SRI value is 'a solar reflectance or solar reflectance index rating that is measured after three years of weather exposure.' - USGBC
What this indicates is how good the product is going to be performing after three years outside. Consider a highly reflective white roof. When it's installed, it's clean and bright white, but the sun

beats down on it day after day, it gets rained on, dust in the air collects on it, etc. After a period of time, it's no longer as bright, and thus performs less optimally. The three-year aged rating takes this into account.

---

37:

Ans.: D

-This choice is the focus of the Location and Transportation category.

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38:

Ans.: B, C

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39:

Ans.: A

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40:

Ans.: B

-An extensive vegetated roof is covered with plants and typically not designed for general access. Usually an extensive system is a rugged green roof that requires little maintenance once established. The planting medium in extensive vegetated roofs ranges from 1 to 6 inches in depth.

Extensive vegetated roofs are less expensive than intensive vegetated roofs because they don't require as much structural support.

- An intensive vegetated roof is one that, compared with an extensive vegetated roof, has greater soil volume, supports a wider variety of plants (including shrubs and trees), and allows a wider variety of uses (including human access). The depth of the growing medium is an important factor in determining habitat value. The native or adapted plants selected for the roof should support the site's endemic wildlife populations.

41:

Ans.: B

---

42:

Ans.: D

Site assessment is one of the most important parts of the integrative process and informs good design decisions.
The site assessment influences over a dozen other LEED credit areas, some directly and others indirectly.

For example:
Access to Quality Transit
Surrounding Density and Diverse Uses
Sensitive Land Protection
Bicycle Facilities
Open Space
Rainwater Management
Heat Island Reduction
Energy Performance
Daylight
Quality Views
Renewable Energy Production

---

43:

Ans.: D

---

44:

Ans.: B

- Light pollution is 'waste light from building sites that produces glare, is directed upward to the sky, or is directed off the site. Waste light does not increase nighttime safety, utility, or security and needlessly consumes energy.

- Light pollution also negatively impacts animals that are nocturnal. There are several strategies to reduce light trespass from a site:
Design to prevent avoid over-lighting
Avoid up-lighting
Reduce glare
Direct full cutoff fixtures downward
Reduce the contrast between light and dark areas
Use shielded fixtures

---

45:

Ans.: B, C

-Quality open spaces encourage interaction, passive recreation, and physical activity.

---

46:

Ans.: A

- Eutrophication is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates from fertilizers or sewage, to an aquatic system.

---

47:

Ans.: B

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48:

Ans.: D

49:

Ans.: A, D

-When properly implemented, construction activity pollution prevention can reduce the compacting of the site's soil due to grading, construction vehicle traffic, and erosion. By avoiding disturbing the soil, natural infiltration from rainwater can be improved and land can be protected (preserving greenfields).

---

50:

Ans.: B

-Good exterior lighting design results in the reduction of three forms of light pollution: uplight, glare, and light trespass.

---

# [Project Surroundings & Public outreach]

1:

Ans.: B

B: The main purpose of building codes are to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures. The building code becomes law of a particular jurisdiction when formally enacted by the appropriate authority.

C: A local ordinance is a law usually found in a municipal code.

D: Zoning is a method of land use regulation used by local governments in most developed countries. Zoning may be use-based (regulating the uses to which land may be put), or it may regulate building height, lot coverage, and similar characteristics, or some combination of these.

---

2:

Ans.: A, C

- Life cycle costing (LCC) is the evaluation of the total cost of a building or product over its useful life, including initial, maintenance, repair and replacement costs as well as savings. LCC evaluates economic performance.

-Reduction in (heat islands, rainwater runoff) environmental benefits which would be determined by life-cycle analysis (environmental analysis).

---

3:

Ans.: A, C

-The IgCC [is a 'model' code, requiring adoption by a governing jurisdiction before it becomes law] is an actual code that is clear and enforceable, similar to codes for electricity and plumbing.

-ASHRAE 189.1[Standard for the Design of High Performance, Green Buildings Except Low-Rise Residential Buildings] is alternate path of compliance to the IgCC.

---

4:

Ans.: A

- The ICC creates codes for building and safety. Many of these codes are adopted by local jurisdictions and become part of the local building code.

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5:

Ans.: A

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6:

Ans.: B

- Reusing a building in a high priority designated area supports all aspects of the triple bottom line.

---

7:

Ans.: A

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8:

Ans.: C

- Value engineering (VE) is a review process that identifies and selects the lowest lifecycle cost options in design, materials and processes that achieves the desired level of performance, reliability and customer satisfaction. In this example the project team is reducing cost by switching to crushed gravel and reducing the heat island effect by using a higher SRI product (thus improving performance). Gravel roads also allow for water to get through the pervious surface.

9:

Ans.: D

- Hard costs: By far the largest portion of the expenses in a construction budget, the hard costs are mostly comprised of the actual construction costs incurred to build the project.
Examples include masonry, wood, steel, carpet, tile, mechanical systems, roofing.

---

10:

Ans.: B

- Studies show that increasing daylighting into schools can increase test scores by 7% to 18%.

---

11:

Ans.: C

- The International Codes, or I-Codes, published by ICC, provide minimum safeguards for people at home, at school, and in the workplace. The I-Codes are a complete set of comprehensive, coordinated building safety and fire prevention codes. Building codes benefit public safety and support the industry's need for one set of codes without regional limitations.

---

12:

Ans.: A

- A soft construction cost is one that is not directly related to building, construction, etc. These can be architectural, legal, financing, engineering fees, commissioning, and other costs incurred before and after construction.

- Hard costs: By far the largest portion of the expenses in a construction budget, the hard costs are mostly comprised of the actual construction costs incurred to build the project. Examples include masonry, wood, steel, carpet, tile, mechanical systems, roofing.

---

13:

Ans.: C

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14:

Ans.: A

-Environmental externalities are transactions in which one or more parties to the transaction are not compensated and may have little choice in the transaction.

Air pollution, for example, is a visible externality of manufacturing, the cost of which is generally paid by others.

Externalities can be either negative or positive for both parties affected. Consider the effects of locating an oil refinery adjacent to a residential neighborhood: air pollution and associated health effects, noise pollution, light pollution, increased traffic, risk of industrial accident (all negative externalities) and availability of high-paying jobs, increased tax base for schools and other infrastructure (positive effect).

---

15:

Ans.: B

- Regenerative design is sustainable plans for built environments that improve existing conditions. Regenerative design goes beyond reducing impacts to create positive change in the local and global environment.
By generating more electricity than the project uses, the system is considered regenerative.

---

16:

Ans.: C

- The manual states project teams should determine relevant design fees and construction costs. Also address:

1. Life cycle costing

2. Design and cost advice from experienced green building professionals

3. Contingencies for research of unconventional techniques or materials

Life cycle costing compares different designs to determine the best long-term investment. All building expenses are included in the analysis including:

Initial costs (design + construction)

Operating costs (utilities, water, electricity, people)

Maintenance costs (repair, replacement, upkeep)

---

17:

Ans.: A

- Many projects in the past have earned Innovation credits by included an on site education program showing the green features of the building. Install some signs around the project, create a map of the project, promote the tour, and you are well on your way. This would not be that expensive to do.

- Construction waste hauling fees, This is a hard cost.

---

18:

Ans.: A, D

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19:

Ans.: B

A: The daylighting itself is a design choice, not an externality.

B: Decreased absenteeism is a by-product of healthier buildings.

C: Energy efficiency is not an externality for an occupant.

D: Water reduction is not an externality for an occupant.

---

20:

Ans.: A

-There are different incentives for rewarding developers or homeowners who practice green building techniques spurs innovation and demand for green building technologies.
*Structural incentives include:
Expedited review / permitting process
Density and height bonuses
*Financial incentives include:
Tax credits
Fee reductions / waivers
Grants
Revolving loan funds (low-interest loans)
*Non-finanical incentives include:
Technical assistance
Marketing assistance

---

21:

Ans.: A

A: According to Cost of Green Revisited - The 2006 study shows essentially the same results as 2004: there is no significant difference in average costs for green buildings as compared to non-green buildings.

B: LEED building is still taking place despite increases in construction costs.

C: Green design should not be an add-on. Green design should be considered in the pre-design phase. When green design is considered later (construction) phase the costs go up significantly and the building usually doesn't perform as well.

D: LEED teams are achieving LEED certification through similar, low cost approaches. Most times the strategies among projects are very similar for those projects that have similar goals. Widely diverse methods would indicate every project is doing something significantly different than other projects.

22:

Ans.: B

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23:

Ans.: D

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24:

Ans.: A

A: Life cycle assessment (LCA) is the investigation and valuation of the environmental impacts of a given product or service. LCA evaluates environmental performance. This view takes into account the whole life of a product or project (not assessing it from a single point in time).

B: Life cycle costing (LCC) is the evaluation of the total cost of a building or product over its useful life, including initial, maintenance, repair and replacement costs as well as savings. LCC evaluates economic performance.

C: A soft construction cost is one that is not directly related to building, construction, etc. These include building permit fees, architect fees, legal, financing, engineering fees, commissioning, and other costs incurred before and after construction.

D: By far the largest portion of the expenses in a construction budget, the hard costs are mostly comprised of the actual construction costs incurred to build the project. The hard-cost categories are the bricks and mortar of the project. Examples of hard costs include masonry, wood, steel, carpet, tile, mechanical systems, roofing.

---

25:

Ans.: D

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26:

Ans.: B

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27:

Ans.: A

- Alternative Compliance Paths, or ACPs, allow international projects to identify equivalent means of demonstrating compliance to the credit requirements. For example, where an equivalent country's reference standard exists, an ACP can allow for the use of that standard.
These options address different geographic and climactic regions while providing solutions to challenges faced by projects at a regional level.

---

28:

Ans.: A, B

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29:

Ans.: C

-You might hear the triple bottom line referred to in different ways:
The three P's: profit, planet, and people
The three E's: economics, ecology, social equity
Social capital (people), economic capital (profit), natural capital (planet)
Economic viability, environmental stewardship, social awareness

---

30:

Ans.: C

31:

Ans.: C

- Research shows by improving indoor air quality, adding daylighting and views, occupant productivity goes up.

---

32:

Ans.: D

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33:

Ans.: B

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34:

Ans.: B

A: Adaptive reuse is the design and construction of a building so that it can serve a future use that is different than its current use.

B: Regenerative design, Sustainable plans for built environments that improve existing conditions.

C: Passive design uses sunlight and natural air-flows to help with heating, cooling, and lighting.

D: Net-zero energy projects use no more energy from the grid than they produce on site.

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35:

Ans.: B

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36:

Ans.: B, C

37:

Ans.: A

-Life cycle assessment (LCA) is the investigation and valuation of the environmental impacts of a given product or service. LCA evaluates environmental performance. This view takes into account the whole life of a product or project (not assessing it from a single point in time).
The goal of LCA is to compare the full range of environmental and social damages assignable to products and services to be able to choose the least burdensome one

---

38:

Ans.: A

A: Operating costs are another type of cost for a building in addition to hard and soft costs. These costs occur after the building is complete and up and running. These costs include utilities such as water and electricity as well as the costs of maintenance personnel – janitorial, landscape, security.

B: Design of a sedimentation control plan is a soft cost.

C: Attorney fees are a type of soft cost.

D: Carpet installation is a hard cost.

---

39:

Ans.: C

A: This would be your ongoing operations costs, which is typically salaries for people.

B: Building commissioning costs are much higher than the cost of a one-day charrette.

C: The cost of the charrette and the time of each team member for the one day is pretty insignificant compared to the benefits and cost savings of the integrative process.

D: Carpet installation is a hard cost.

40:

Ans.: C

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41:

Ans.: D, E, F

---

42:

Ans.: B

-USGBC collects water and energy usage from LEED projects. This information helps the development of future LEED rating system versions.

---

43:

Ans.: D

---

44:

Ans.: A

- Projects should prepare and review a list of the appropriate and applicable laws, codes, local ordinances, statutes, and industry-related standards relevant to the project.

B: This defines local codes.

C: This defines local zoning.

D: This is not the correct definition.

---

45:

Ans.: C

46:

Ans.: B, D

---

47:

Ans.: D

- In the United States, buildings account for:
14% of potable water consumption
30% of waste output
40% of raw materials use
38% of carbon dioxide emissions
24% to 50% of energy use
72% of electricity consumption

---

48:

Ans.: A

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49:

Ans.: C, E

---

50:

Ans.: B

- Consider the same building design for one building located in the suburbs and one located in a dense urban center. Which reduces emissions more?

The one in the suburbs requires users to drive automobiles to it each day, contributing to more than half of the project's emissions.

51:

Ans.: C

- The term built environment refers to any environment that is human-made and provides a structure for human activity, ranging in scale from personal shelter and buildings to neighborhoods and cities that can often include their supporting infrastructure, such as water supply or energy networks.

- Green buildings are structures that provide stronger connections to nature.

---

52:

Ans.: D

---

53:

Ans.: A

- This benefits the people and surrounding community with additional tax revenue.

---

54:

Ans.: C

---

55:

Ans.: D

---

56:

Ans.: B, D

- Local zoning will need to be considered for any building project.

- A nearby LEED ND project may have additional room in the development for the residential project.

---

57:

Ans.: C

LEED-certified buildings are designed to deliver the following benefits:
-Lower operating costs and increased asset value
-Reduced waste sent to landfills
-Energy and water conservation
-More healthful and productive environments for occupants
-Reductions in greenhouse gas emissions
-Qualification for tax rebates, zoning allowances, and other incentives in many cities
The first and last items in the list contribute directly to the economic bottom line.

---

58:

Ans.: D, E

---

59:

Ans.: C

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60:

Ans.: A

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61:

Ans.: A, B, D

---

62:

Ans.: D

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63:

Ans.: B

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64:

Ans.: B

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65:

Ans.: D

- Value engineering (VE) is review process that identifies and selects the lowest lifecycle cost options in design, materials and processes that achieves the desired level of performance, reliability and customer satisfaction.
USGBC has redefined value engineering to mean reducing costs while improving performance.

---

66:

Ans.: C

---

67:

Ans.: D

68:

Ans.: A

---

69:

Ans.: D

---

70:

Ans.: B

- The manual states project teams should determine relevant design fees and construction costs. Also address:
1. Life-cycle cost analysis
2. Design and cost advice from experienced green building professionals
3. Contingencies for research of unconventional techniques or materials

-LEED buildings are supposed to have lower utility costs because the LEED prerequisites require using a percentage less energy and water than conventional buildings.

---

71:

Ans.: A

-Each LEED project type may have different impacts so each rating system has its own RP credits. For example a warehouse may not have high priority for indoor water use if there are not a lot of occupants.

---

72:

Ans.: A

-Ozone depletion is primarily addressed by a building's energy use and choice of refrigerants.

73:

Ans.: C

---

# [Water Efficiency]

1:

Ans.: B, D

- Blackwater is water from toilets or kitchen sinks that has not been treated.

- Potable water usually comes from wells or municipal supplies and should not be used for irrigation.

- Graywater is water from laundry machines or showers that is not suitable for drinking, but can be used for other purposes such as irrigation and flushing toilets.

---

2:

Ans.: B

---

3:

Ans.: B

-The installation of turf grass will increase the watering needs of the landscape.

-Native plants require less irrigation, less fertilizer, and less maintenance than non-native plants.

---

4:

Ans.: B

-Subsystems are not required to be metered in LEED; only building level metering is required.
In LEED v4 building level energy and water metering is a prerequisite.

---

5:

Ans.: D

- Graywater can be used for flushing in water closets and urinals, or process water needs for some systems.

6:

Ans.: D

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7:

Ans.: D

---

8:

Ans.: C

---

9:

Ans.: A

---

10:

Ans.: C

---

11:

Ans.: C

---

12:

Ans.: B

---

13:

Ans.: D

- Composting toilets are not practical for many applications, such as high-rise buildings.

14:

Ans.: B

-Native (or indigenous) plants are those that grow naturally in an area, or that have been in an area for many years. Native plants require less water, fertilizer, and pest control. These plants can be trees, shrubs, flowers, or grasses. Adaptive plants are non-native plants that perform well in the local climate. Native and adaptive plants require less water, and are more disease resistant because they are suited to the region's usual rainfall, soil, and temperature.

---

15:

Ans.: C

- Energy is used to heat, cool, and distribute water within a building. Water heating in commercial buildings accounts for 15% of total energy use (CBECS). Reducing the quantity of water used has a direct impact on the energy it takes to heat, cool, and distribute the water.
Municipal energy is also saved because less water must be treated at sewage plants.

---

16:

Ans.: D

- To optimize systems, the systems must be measured. Submetering helps monitor which systems are using more water.

---

17:

Ans.: D

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18:

Ans.: D

19:

Ans.: C

A, D: Micro-irrigation and drip irrigation are both irrigation techniques.

B: Mulching helps retain moisture for plants, but it is not the BEST strategy from the choices given.

C: Xeriscaping is a landscaping method that employs drought-resistant plants to minimize or eliminate water use.

---

20:

Ans.: B

---

21:

Ans.: C

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22:

Ans.: C

- The answer choice of 'Installing fixtures that meet the EPAct 1992 standard' only meets the baseline standard and does not contribute to reducing potable water use for the purposes of earning LEED credits. Low-flow fixtures help reduce potable water consumption indoors.

---

23:

Ans.: D

---

24:

Ans.: B, D

- ENERGY STAR qualified clothes washers use about 37% less energy and use over 50% less water than regular washers.

- WaterSense is an EPA certification awarded to fixtures that use less water than comparable fixtures.

---

25:

Ans.: C

---

26:

Ans.: B

- Graywater is defined by the Uniform Plumbing Code (UPC) as untreated house-hold wastewater which has not come into contact with toilet waste or kitchen sinks.
Graywater includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washer and laundry tubs. It does not include water from kitchen sinks or dishwashers.

---

27:

Ans.: A

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28:

Ans.: A

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29:

Ans.: B

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30:

Ans.: B, D

31:

Ans.: C

- Water efficiency can be accomplished by efficient irrigation, efficient plumbing fixtures, graywater use, etc.

- LID is 'an approach to managing rainwater runoff that emphasizes on-site natural features to protect water quality, by replicating the natural land cover hydrologic regime of watersheds, and addressing runoff close to its source.

Include better site design principles: minimizing land disturbance, preserving vegetation, minimizing impervious cover.

Design practices: rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, soil amendments.

---

32:

Ans.: A

---

33:

Ans.: A, C

---

34:

Ans.: A, D

- Treatment and definitions of blackwater vary - in some jurisdictions, blackwater is wastewater generated from toilet flushing; in others, it includes water from kitchen sinks or laundry facilities. It is distinct from greywater or sullage, the residues of washing processes.

---

35:

Ans.: A

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36:

Ans.: A, C

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37:

Ans.: A

-For both energy efficiency and water efficiency, LEED requires an efficiency-first approach. Efficiency is 'doing the same with less'. After efficiency, the focus should then be placed on other ways to reduce demand.

---

38:

Ans.: B, C

- A full-time equivalent (FTE) represents a regular building occupant in a project building. An FTE of 1.0 means that the person is equivalent to a full-time worker, while an FTE of 0.5 signals that the worker is only half-time.
Transient occupants (visitors, guests), along with Full Time Equivalents, are used when calculating reductions in water usage, and some alternative transportation credits.

---

39:

Ans.: A, B

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40:

Ans.: D

- Early in the design process, project teams need to establish a water balance and see what is legal within the project for reclaimed water, black water, graywater collection, and rainwater harvesting. If these items are not addressed early and a graywater collection system is already being constructed under the building, it can't necessarily be easily or cheaply removed.

---

41:

Ans.: B

---

42:

Ans.: B

Building level metering will track the whole building's water use but not allow a determination regarding whether the irrigation potable water use is being reduced. Irrigation water use would have to be tracked separately.

---

43:

Ans.: C

- The landscape area would need to be documented to show the types of plants, the different areas of vegetation, where irrigation will go, etc.

---

44:

Ans.: B, D

---

45:

Ans.: D

---

46:

Ans.: B

---

47:

Ans.: A

---

48:

Ans.: B, C, D

---

49:

Ans.: B

-Process water is 'water that is used for industrial processes and building systems, such as cooling towers, boilers, and chillers. It can also refer to water used in operational processes, such as dishwashing, clothes washing, and ice making.'

---

50:

Ans.: D

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51:

Ans.: D

A: This is blackwater.

B: This is just recycled water.

C: This is a source of non-potable water for uses such as irrigation.

D: Graywater is defined by the Uniform Plumbing Code (UPC) as untreated house-hold wastewater which has not come into contact with toilet waste or kitchen sinks.
Graywater includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washer and laundry tubs. It does not include water from kitchen sinks or dishwashers.

---

52:

Ans.: A, C, D

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53:

Ans.: B

- A dry pond (detention pond) is used to store excess rainwater. Dry ponds are basins whose outlets have been designed to detain runoff for some minimum time (e.g., 24 hours). The rainwater will slowly seep into the ground to recharge aquifers or discharge as determined by the pond design to allow pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool of water.

---

54:

Ans.: C

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55:

Ans.: B

---

56:

Ans.: C

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57:

Ans.: D

-The water budget approach serves as a design tool, allowing the professional to design a sustainable landscape based on a regionally appropriate amount of water. A water budget is a site-specific method of calculating an allowable amount of water to be used by the landscape and then designing the landscape to meet this budget. The budget takes into account plant type, plant water needs, irrigation system design, and applied water that the landscape receives either by irrigation or by precipitation. Water budgets must be associated with a specified amount of time, such as a week, month, or year.

---

58:

Ans.: B

-When calculating indoor water use baselines or design cases, the calculations are based on the number of occupants in the building using the fixtures.

---

59:

Ans.: A, E

---

60:

Ans.: B

---

61:

Ans.: D

- Retrofitting/designing a building with flow-restrictors and reduced-flow aerators helps reduce water use.

---

62:

Ans.: D

- The knowledge of how much rain falls on the site will be needed for rainwater management. This information also helps the landscape designer determine the type of irrigation, plant selection, and areas of vegetation.

---

63:

Ans.: A

---

64:

Ans.: B

---

65:

Ans.: C

- Turf requires large amounts of irrigation and would impact the project's ability to reduce outdoor water use.

- Increasing plant density helps retain rainwater.

# [Energy & Atmosphere]

1:

Ans.:  A, D

-Wind, solar, and biomass are types of renewable energy sources (green power) LEED rewards projects for using.

-Coal, nuclear, natural gas, oil, and other fossil fuels have greater environmental impacts to the air and water.

---

2:

Ans.: A

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3:

Ans.: A

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4:

Ans.: C

-Lighting power density is the installed lighting power per unit area (the amount of electrical power used to illuminate a space). It is usually expressed in Watts per unit of area.

---

5:

Ans.: D

---

6:

Ans.:  D

---

7:

Ans.: A

-Demand response allows utilities to call on buildings to decrease their electricity use during peak times, reducing the strain on the grid and the need to operate more power plants, thus potentially avoiding the costs of constructing new plants.

A demand response program can work for the most demanding energy projects - data centers, refrigeration, or fully occupied buildings in areas that hit 110 F degrees (43 C) in the summer.

---

8:

Ans.: D

EPA created ENERGY STAR Portfolio Manager, an online tool to measure and track energy and water consumption, as well as greenhouse gas emissions. Use it to benchmark the performance of one building or a whole portfolio of buildings.

---

9:

Ans.: D

-Demand response allows utilities to call on buildings to decrease their electricity use during peak times, reducing the strain on the grid and the need to operate more power plants, thus potentially avoiding the costs of constructing new plants.

---

10:

Ans.: D

---

11:

Ans.: B

12:

Ans.: B

---

13:

Ans.: C

- Commissioning can be expensive but, compared to the savings it achieves over time, it's one of the best investments a building owner can make. There are many studies that show the benefits of commissioning with examples of installation errors that cost building owners thousands of dollars a year unnecessarily.
A study by the Lawrence Berkeley National Laboratory found the following: 'For existing buildings, we found median commissioning costs of $0.27/ft2, whole-building energy savings of 15 %, and payback times of 0.7 years. For new construction, median commissioning costs were $1.00/ft2 (0.6 % of total construction costs), yielding a median payback time of 4.8 years (excluding quantified non-energy impacts).

---

14:

Ans.: D

- The space types in LEED sometimes have different requirements.
For example, the lighting requirements may differ for an individual occupant (task lighting) or for a shared multi-occupant space (occupancy sensors).

---

15:

Ans.: B

- On-site renewable energy (solar, wind, geothermal) would help the project generate all of the electricity it needs.

A net-zero energy (NZE) building is one that relies on renewable sources to produce as much energy as it uses, usually as measured over the course of a year. Net-zero energy buildings start with energy-conscious design.

A net-zero building that produces more energy than it needs can feed the excess back into the grid and earn revenue through net-metering.

---

16:

Ans.: C

-Under the Montreal Protocol, CFC production in the United States ended in 1995. To implement the Montreal Protocol, the EPA established Section 608 of the EPA Clean Air Act for regulating the use and recycling of ozone-depleting compounds.

-EPA Clean Air Act specifies disposal procedures for CFCs among other things.

-This is a protocol aimed to fight global warming. LEED does not reference this protocol.

---

17:

Ans.: A

- GWP is Global Warming Potential
CO2 has a GWP of 1.
The lower the GWP the better the refrigerant is for the environment.

---

18:

Ans.: C, D.

-Combined heat and power (CHP) is an electricity generation technology, also known as cogeneration, which recovers waste heat from the electric generation process to produce simultaneously other forms of useful energy, such as usable heat or steam. On average, two-thirds of the input energy used to make electricity is lost as waste heat. In contrast, CHP systems are

capable of converting more than 70% of the fuel into usable energy.
Because less fuel is burned to produce each unit of energy output, CHP reduces air pollution and greenhouse gas emissions.

---

19:

Ans.: A, D, F.

-When calculating the Minimum Energy Performance of a building the energy calculations take into account process and non-process energy. The best way to remember the difference is process energy *generally* comes from equipment that is plugged into a wall outlet (it has a plug load). Examples of process energy include:

- Computers
- Office equipment
- Kitchen stoves
- Kitchen refrigerators
- Washers and dryers
- Elevators and escalators (these don't have regular plugs, but are considered process energy for LEED)

-Non-process, or regulated energy generally includes built-in building components:

- Interior and exterior lighting (parking garage, security, landscape, architectural)
- HVAC (heating, cooling, fans, pumps)
- Hot water heating
- Toilet exhaust
- Parking garage ventilation

---

20:

Ans.: A

- The project team can replace or retrofit the existing system with one that is CFC-free, or agree to have a phase out plan that is completed 5 years after project completion.

21:

Ans.: D

---

22:

Ans.: B, E, F

---

23:

Ans.: A

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24:

Ans.: C

-The plug load or receptacle load is 'the electrical current drawn by all equipment that is connected to the electrical system via a wall outlet.

- ENERGY STAR labeled appliances perform better and increase energy efficiency.

---

25:

Ans.: D

- For both energy efficiency and water efficiency, LEED requires an efficiency-first approach. Efficiency is 'doing the same with less'. After efficiency, the focus should then be placed on other ways to reduce demand.
For example, with outdoor water irrigation, if the design only calls for using rainwater irrigation, that doesn't improve the efficiency of the irrigation system, resulting in less water use. First design the landscape to use less water, than look at ways to reuse water to further reduce demand.
For building energy use, you can increase efficiency by using LED lighting, ENERGY STAR appliances and equipment, high-efficiency HVAC systems, and high-efficiency boilers.

---

26:

Ans.: C

---

27:

Ans.: B

---

28:

Ans.: C

- Retrocommissioning is a commissioning process that can be performed on existing buildings to identify and recognize system improvements that make the building more suitable for current use. Retrocommissioning usually occurs at least one year after the building has been occupied.

---

29:

Ans.: A

- The staff must understand the systems and how to use them or else the design of the systems is irrelevant.

---

30:

Ans.: A

- Demand-response programs usually include financial incentives during demand response events. The utility company asks the building to use less electricity, the building agrees, and the building owner is rewarded with a price break. In turn, the utility company saves money by spending less money on additional transmission lines and power plants.

31:

Ans.: D

---

32:

Ans.: A

-Operational energy efficiency is the ongoing process of maintaining a building's systems so that it operates at peak design.

---

33:

Ans.: B

---

34:

Ans.: C

- On average, two-thirds of the input energy used to make electricity is lost as waste heat. In contrast, CHP systems are capable of converting more than 70 % of the fuel into usable energy.

---

35:

Ans.: B

- A study by the New Buildings Institute found that in green buildings, average energy use intensities (energy consumed per unit of floor space) are 24% lower than in typical buildings.

---

36:

Ans.: D

---

37:

Ans.:  C, E

---

38:

Ans.:  B

---

39:

Ans.:  B

A: This person reviews the submitted credit documentation. They do not show up on site and test systems.

B: This is another way of asking who is responsible for commissioning.

C: The project administrator is not responsible for this (unless they are also the commissioning authority).

---

40:

Ans.: C

-Refrigerants have ozone depletion potential (ODP) and global warming potential (GWP) due to greenhouse gas emissions. Low values of each are best for refrigerant choices.

---

41:

Ans.: C

---

42:

Ans.: A

43:

Ans.: D

-A district energy system (DES) is a central energy conversion plant and transmission and distribution system that provides thermal energy to a group of buildings (e.g., a central cooling plant on a university campus). It does not include central energy systems that provide only electricity.

---

44:

Ans.: B, E

---

45:

Ans.: A

---

46:

Ans.: A

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47:

Ans.: B

---

48:

Ans.: A

---

49:

Ans.: D

---

50:

Ans.: C

---

51:

Ans.: B

---

52:

Ans.: A, C

---

53:

Ans.: B

---

54:

Ans.: C, D

- Under the Montreal Protocol no production and no importing of any HCFCs is permitted after 2030. A 90% phase-out is required by 2015 of HCFCs.

- CFCs were banned under the Montreal Protocol in 1995.

---

55:

Ans.: B

- Demand response allows utilities to call on buildings to decrease their electricity use during peak times, reducing the strain on the grid and the need to operate more power plants, thus potentially avoiding the costs of constructing new plants.

---

56:

Ans.: A

- The most common way (according to LEED) of meeting the requirements of off-site renewable energy is by purchasing RECs. Many local utility companies currently are either closed markets or do not offer renewable alternatives.

---

57:

Ans.: B

-This strategy maximizes a building's ability to use natural lighting and natural heating.

-Increasing thermal mass provides improved insulation to save energy.

---

58:

Ans.: B

---

59:

Ans.: C

---

60:

Ans.: A

- A study by the Lawrence Berkeley National Laboratory found the following: 'For existing buildings, we found median commissioning costs of $0.27/ft2, whole-building energy savings of 15%, and payback times of 0.7 years. For new construction, median commissioning costs were $1.00/ft2 (0.6 % of total construction costs), yielding a median payback time of 4.8 years (excluding quantified non-energy impacts).

---

61:

Ans.: A

---

62:

Ans.: C

---

63:

Ans.: C

- Onsite renewable energy systems typically have high upfront costs (first costs). These costs can be offset (but not always) by leasing systems or getting tax credits and other incentives.
By purchasing RECs or green power from a utility company the building owner can reduce emissions while not having the large upfront costs of an onsite system.

---

64:

Ans.: D

---

65:

Ans.: C

---

66:

Ans.: D

-For LEED biofuels include:

- untreated wood waste
- agricultural crops or waste
- animal waste
- other organic waste

- landfill gas

---

67:

Ans.: A, D, F

-Read the Space Categorization section of the EQ Overview at http://www.usgbc.org/guide/bdc for information on space types and occupied vs. unoccupied spaces.
Further, pay attention to the differences between regularly occupied spaces vs. nonregularly occupied spaces, and also individual occupant spaces vs. shared multioccupant spaces.

---

68:

Ans.: D

---

69:

Ans.: A

-Net metering is the term for selling excess electricity back to the grid. Net metering can only be done when on-site renewable energy systems are present.

---

70:

Ans.: D

- Reducing energy demand, or conservation, considers strategies to reduce building loads.
Increasing thermal mass increases a building's insulation properties allowing it to maintain a more constant temperature thus reducing the need for heating and cooling.
Photovoltaics are a type of renewable energy.

---

71:

Ans.: D

-Commissioning is 'the process of verifying and documenting that a building and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements.' - USGBC

The systems cannot be commissioned until they are installed. The process takes place prior to occupancy (usually) when the building is substantially completed. For example, all of the HVAC systems are in, the building has water and power, etc. Things that don't need to be in place are painting, carpets, tile, etc.'

---

72:

Ans.: A, B

- Retrocommissioning and BAS systems can be used to keep a building running efficiently and identify issues that need to be addressed.

- Building automation systems (BAS) collect data about a building's systems and track it over time. The data can be used to determine trends or anomalies, which can then serve to help fix or update the systems.

- Retrocommissioning is 'a commissioning process that can be performed on existing buildings to identify and recognize system improvements that make the building more suitable for current use.' - USGBC

---

73:

Ans.: D

-The up-front costs will probably be higher unless the owner can find a utility provider to install the system for free and then agree to purchase the renewable energy from the provider.

---

74:

Ans.: A

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75:

Ans.: B, D

-Commissioning and ongoing commissioning are intended to improve energy performance once the building is operational.

-Metering of the building systems helps the staff track any issues that would impact energy performance.

---

76:

Ans.: C

---

77:

Ans.: C

-Existing buildings that have CFC based systems are still eligible for certification. A phase out plan must be implemented if a third party audit shows that the simple payback for the new system would be 10 years or less.

-Replacement is not always required. If a third party audit shows that the simple payback for the new system would be more than 10 years the system does not have to be replaced.

---

78:

Ans.: D

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79:

Ans.: B

---

80:

Ans.: D

---

81:

Ans.: C

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82:

Ans.: D

- On average, the distribution of a building's energy use is as follows:

Space Heating - 36%
Lighting - 21%
Cooling - 8%
Water Heating - 8%
Ventilation - 7%
Refrigeration - 6%
Cooking - 3%
Computers - 2%
Office Equipment - 1%
Other - 8%

---

83:

Ans.: D

-During the integrative process, project teams consider several design topics related to energy:

Energy demand
Energy efficiency
Using renewable energy
Ongoing performance of the building's systems

It is important to understand how a design decision falls into one of these categories.

---

84:

Ans.: B, C

-HFCs (HydroFluoroCarbons) are not covered in the Montreal Protocol. These refrigerants have low Ozone Depletion Potential but typically high Global Warming Potential.

---

# [Materials & Resources]

1:

Ans.: A

- The purpose of having manufacturers disclose materials is for project teams to make better decisions and encourage manufacturers to make efforts to improve the environmental qualities of their products over time.

---

2:

Ans.: A

-Specifications are created by architects and given to the contractor for the purposes of purchasing the right quantity and type of materials. Specifications include drawings of what is to be built. They are legally binding documents. Specifications are detailed

---

3:

Ans.: A

- When purchasing materials a certain number of products must be selected to meet LEED credit requirements.

For LEED a product must be a permanently installed building product, and is defined as 'an item that arrives on the project site either as a finished element ready for installation or as a component to another item assembled on-site.' - USGBC
Example products include: steel, wood, drywall, carpet.
Things that are not considered products that count towards the MR credits include:
Scaffolding
Concrete formwork
Anything temporary

---

4:

Ans.: B, C, F

-The three correct choices are examples of source reduction and space-efficient strategies.

---

5:

Ans.: A

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6:

Ans.: B

- Do not confuse recycled content with reused materials. Recycled content contains materials that have been recycled. An example is insulation made from recycled newspapers.

- Reused materials are construction materials recovered from building sites and reused on different building sites in the same or a different capacity. Examples can include flooring, brick, beams, and doors.

- Virgin wood is new wood. Since the wood flooring was obtained from the demolition project the wood was not new and was not cut down from a forest specifically for the use in the project.

---

7:

Ans.: B, C

- With Building Disclosure and Optimization remember there are two parts - the disclosure and the optimization.
The disclosure is about transparency, which includes environmental product declarations (life-cycle impacts), material ingredients (health product declarations), and raw materials sourcing (corporate sustainability reports).
The optimization is about using a certain quantity or percentage of those products that have disclosure for the project. Optimization usually includes a third party certification for the product.

For material ingredients those certifications are GreenScreen and Cradle-to-Cradle Certified.
Choosing products that have met one of those standards helps earn the credit.
For international projects REACH Optimization can be used instead.

---

8:

Ans.: D

- One reason to do an LCA of a building is to be able to compare different material choices and see how they impact the project over the building's life.

---

9:

Ans.: C

---

10:

Ans.: A, C

- Reuse - whether a building or material - prevents the building or material from ending up in the landfill, extending the landfill's life.

- Because less new materials are required, virgin resources are preserved.

---

11:

Ans.: B

- Waste-to-energy is 'the conversion of nonrecyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery'
It's quite popular and Europe and becoming more common. When strict air-quality guidelines are followed, it's a good way to dispose of trash and generate energy in the process.

12:

Ans.: B

- Reused materials are construction materials recovered from building sites and reused on different building sites in the same or a different capacity. Examples can include flooring, brick, beams, and doors.

---

13:

Ans.: A

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14:

Ans.: A

- A construction waste management plan should address what materials will be diverted from the landfill, as well as how they will be diverted and how the plan will be policed.

---

15:

Ans.: C, F

-Ongoing consumables are 'a product that has a low cost per unit and is regularly used and replaced in the course of business. Examples include paper, toner cartridges, binders, batteries, and desk accessories. Also known as ongoing purchases.'

-Durable goods are 'products with a useful life of approximately two or more years and that are replaced infrequently. Examples include furniture, office equipment, appliances, external power adapters, televisions, and audiovisual equipment.'

---

16:

Ans.: D

17:

Ans.: A, C, D

*Post-consumer material* - recycled material generated from the waste of household, commercial, industrial, or institutional end-users

*Postconsumer recycled content* - is the percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain. Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings). (ISO 14021)

*Pre-consumer content* - formerly known as post-industrial content, is the percentage of material in a product that is recycled from manufacturing waste. Examples include planer shavings, plytrim, sawdust, chips, bagasse, sunflower seed hulls, walnut shells, culls, trimmed materials, print overruns, overissue publications, and obsolete inventories. Excluded are materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it (ISO 14021).

---

18:

Ans.: A, C

- An LCA provides insight into the building design. Through this process the materials may be reduced.

- One reason to do an LCA of a building is to be able to compare different material choices and see how they impact the project over the building's life.

- The project costs may go up or down depending on the results of the LCA and the influence these results have on the design.

---

19:

Ans.: B

- Specifications are created by architects and given to the contractor for the purposes of purchasing the right quantity and type of materials. Specifications include drawings of what is to be built. They are legally binding documents. Specifications are detailed.

---

20:

Ans.: C

- Cradle to cradle is a term used in life-cycle analysis to describe a material or product that is recycled into a new product at the end of its useful life. Cradle to cradle is an example of a closed system.

- Cradle to grave is a view of materials and products where products that have reached the end of their useful lives are considered worthless. This is a type of open system.

- Some forms of energy are described as renewable. Building materials are usually reused, salvaged, refurbished, but not renewable.

---

21:

Ans.: A, B

- Environmentally preferable products have known end-of-life scenarios for when the product needs to be replaced to keep them out of the landfill. These are frequently called take-back programs.

In LEED credit, the take-back program is a type of extended producer responsibility, defined as: 'Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life. Producers recover and recycle the materials for use in new products of the same type. To count toward credit compliance, a program must be widely available. For carpet, extended producer responsibility must be consistent with NSF/ANSI 140-2007. Also known as closed-loop program or product take-back.'

22:

Ans.: A

-Source reduction is the first and best way to minimize waste. Source reduction starts at the source- such as pre-ordering materials cut to size and choosing modular construction, which generates less onsite waste.

-Using salvaged materials does not reduce waste at the source.

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23:

Ans.: B

-A CSR report is a third-party verified report that includes information on how the manufacturer extracts or sources materials.

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24:

Ans.: B

- Standard fluorescent lamps contain mercury.

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25:

Ans.: B

- Source reduction reduces the materials brought into a building. This includes products that have reduced packaging and products developed with sustainable design principles.

---

26:

Ans.: C

-The term greenwashing is generally used when significantly more money or time has been spent advertising being green, rather than spending resources on environmentally sound practices.

The term greenwashing was coined by New York environmentalist Jay Westervelt in a 1986 essay regarding the hotel industry's practice of placing placards in each room promoting reuse of towels ostensibly to 'save the environment'. Westerveld noted that, in most cases, little or no effort toward reducing energy waste was being made by these institutions – as evidenced by the lack of cost reduction this practice effected. Westerveld opined that the actual objective of this 'green campaign' on the part of many hoteliers was, in fact, increased profit. Westerveld thus labeled this and other outwardly environmentally conscientious acts with a greater, underlying purpose of profit increase as greenwashing.

---

27:

Ans.: D

– Increasing the size of the building footprint would likely increase the amount of construction waste.

– To reduce construction waste, divert any unused materials from the waste stream–namely, landfills and incinerators.
Materials can be donated, sold, or recycled, to keep them out of landfills and to help reduce the demand for virgin materials.

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28:

Ans.: B, D

– *Postconsumer recycled content* – is the percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain. Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings). (ISO 14021)

29:

Ans.: B

- Designing for flexibility is a concept that considers the future use of the building and how it may be modified while at the same time reducing waste and reducing the need for new materials. Modular room partitions, modular furniture, and zoned utility systems allow for future expansion.

- Additional buildings would extend the project but this choice does not conserve resources.

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30:

Ans.: C, E, F

C: This is the economic portion of the triple bottom line.

E: This is the social portion of the triple bottom line.

F: This is the environmental portion of the triple bottom line.

-This is an example of selecting a material based on the triple bottom line, which is how USGBC is guided by their decisions.

---

31:

Ans.: C

- Health Product Declaration (HPDs) provide a full disclosure of the potential chemicals of concern in products by comparing product ingredients to a wide variety of 'hazard' lists published by government authorities and scientific associations.
The HPD itself does not indicate if a product is healthy, it merely reports on the material ingredients. Armed with this information project teams can compare the materials in different products and see if any of the products contain unhealthy materials or in what quantities.

---

32:

Ans.: C

- Salvaged materials reduce the demand for virgin materials and reduce waste.

---

33:

Ans.: C

- Each building disclosure and optimization credit in the Materials and Resources section has two options for compliance. The first option is for material transparency - what's in the material or how was it obtained. There are third party certifications used to confirm transparency. Transparency in the materials credits comes from publishing:

EPDs, which include the life-cycle impacts of a product.

CSRs help to identify products/manufacturers that have been verified to be extracted or sourced in a responsible manner.

'HPD' is an acronym for 'Health Product Declaration.' The HPD is a standard format for reporting product content and associated health information for building products and materials. HPD is free for all to use. The HPD's ongoing development, maintenance, and evolution is grounded in a transparent process that relies on input from both customers and producers and is overseen by the non-profit Health Product Declaration Collaborative.

The other option is an optimization path. This one requires teams to use products that are certified by a third party to demonstrate an impact reduction below industry average.

34:

Ans.: A, B

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35:

Ans.: B

- REACH is the Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals. REACH requires all companies manufacturing or importing chemical substances into the European Union in quantities of one ton or more per year to register these substances.

The main aims of REACH are to ensure a high level of protection of human health and the environment from the risks that can be posed by chemicals, the promotion of alternative test methods, the free circulation of substances on the internal market, and enhancing competitiveness and innovation.

REACH makes the industry responsible for assessing and managing the risks posed by chemicals and providing appropriate safety information to their users.

LEED products that do not contain substances in the Authorization List or Candidate List can be used to meet certain credit requirements in the Materials and Resources category.

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36:

Ans.: C, D, F

-wood: 'plant-based materials that are eligible for certification under the Forest Stewardship Council. Examples include bamboo and palm (monocots), as well as hardwoods (angiosperms) and softwoods (gymnosperms).'

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37:

Ans.: C

-The construction waste management plan will describe where construction and demolition debris is going to go. The plan outlines diverting construction debris from landfills through reusing, salvaging, and recycling materials. Part of this decision is to use commingled or separate recycling. Only your actual construction and demolition debris are included – wood scraps, metal, drywall, cardboard boxes, etc.
The plan should include a target diversion rate (a goal that can be measured) such as 'divert 75% of construction waste'. Construction waste is calculated by weight or volume.

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38:

Ans.: A

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39:

Ans.: D

-Embodied energy is an accounting methodology which aims to find the sum total of the energy necessary for an entire product lifecycle. This lifecycle includes raw material extraction, transport, manufacture, assembly, installation, disassembly, deconstruction and/or decomposition.

-When selecting a building material there are three things that should be considered:

1. Performance – How will the material perform compared to other alternatives? Consider insulation – should the project use foam insulation, batt insulation, or something else for the best insulating properties?

2. Adaptability – Can the insulation be reused in the future when the building is at the end of its life or will it need to be disposed of?

3. Embodied energy – How much energy went into manufacturing each type of insulation being

considered. Was the insulation sourced close by or was manufactured in an environmentally unfriendly plant and then shipped from overseas?

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40:

Ans.: A, B, E

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41:

Ans.: B, D, E

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42:

Ans.: A

- School projects have a prerequisite for acoustics. This choice is a reused product, which is preferable because it doesn't require any raw material extraction.

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43:

Ans.: A

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44:

Ans.: C

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45:

Ans.: A

- Adaptive reuse is the practice of redesigning and using a structure for a use that is significantly different from the building's original use.

46:

Ans.: A

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47:

Ans.: A

- The greater the density of a project, the more environmentally friendly it is. Putting more people into a building compared to building more buildings is better.
Mixed-use projects such as putting apartments on top of retail stores reduce materials because the project isn't building separate buildings for residential and retail. Less buildings means less new materials.
Finally, more dense building requires less roads and infrastructure, saving more materials.

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48:

Ans.: B

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49:

Ans.: B

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50:

Ans.: A

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51:

Ans.: A, B

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52:

Ans.: C

Source reduction, also known as waste prevention or pollution prevention, is the elimination of waste before it is created. It involves the design, manufacture, purchase or use of materials and products to reduce the amount or toxicity of what is thrown away.
An example of source reduction is using less packaging to ship a product or material or using dimensional lumber of the exact size needed.
The four preferred strategies of the EPA for reducing waste are, in order:

Source reduction
Reuse
Recycling
Waste to energy

---

53:

Ans.: B

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54:

Ans.: D

- EPDs act as neither product ratings nor ecolabels; rather, they help architects, designers, specifiers, and other purchasers better understand a product's sustainable qualities and environmental repercussions. As such, EPDs equip manufacturers with a valuable tool for differentiation and empower customers to make more informed purchasing decisions.

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55:

Ans.: B, C

-A material that is reused or repurposed is more sustainable than a new material, and frequently it is cost effective to include these in a project.

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56:

Ans.: C

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57:

Ans.: C

- Material Safety Data Sheets are intended to provide workers and emergency personnel with procedures to safely handle a product during fabrication, installation, or in a life-safety event. The information given in an MSDS is not a comprehensive disclosure of contents, nor does it fully address all potential health hazards that may be associated with a product.

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58:

Ans.: C, D

C: This strategy is part of designing for flexibility which reduces the demand for new building materials over time.

D: Reusing materials or furnishings reduces the demand for new materials and thus preserves virgin resources.

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59:

Ans.: A, C, D

Restoration, preservation, and rehabilitation are three types of building reuse which will help reduce the energy use and waste from tearing down a building.

# [Indoor Environmental Quality]

1:

Ans.: B

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2:

Ans.: B, D

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3:

Ans.: C

- A green cleaning policy should include:
1. The standards used to select products and technologies such as Green Seal or California Code of Regulations.
2. Certification of cleaning equipment from the carpet and rug institute.

- Replacing MERV filters is part of operations and maintenance to improve air quality.
Selection of low VOC materials, furniture, and finishes during the building process helps improve indoor air quality of the occupants.

- Measures to prevent against unwanted pests is part of integrated pest management (IPM).

- A waste stream audit is part of a waste-stream policy and improving indoor air quality.

---

4:

Ans.: A

-Environmental Choice has many standards that apply to green cleaning products.

-Green Label Plus indicates carpets have low VOC content.

-The Carpet and Rug Institute has certifications for carpet, carpet pads, and carpet cleaning equipment.

-Green-e is for RECs and carbon offsets.

5:

Ans.: D

-A green cleaning policy is intended to reduce levels of chemical, biological, and particulate contaminants that can compromise air quality, human health, building finishes, building systems, and the environment.

---

6:

Ans.: D

- What is this question really asking? A building material got wet, what does that impact? For good indoor air quality, remember a general contractor is responsible for keeping building materials dry so that no mold is introduced into the building.
Installing it or waiting for it to dry and then installing it are not good options (how could it be known for certain that it's dry below the surface?).
Sending it to the landfill is not good for the environment.
The seller might replace it and send the damaged materials back to be ground up into new product.

---

7:

Ans.: D

- The project manufacturer will have a Material Safety Data Sheet (MSDS) that lists the VOC content of the paint.

- LEED Online does not have a materials database.

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8:

Ans.: B, C, D

-The survey is about IEQ. Any choice unrelated to that credit area can be eliminated.

9:

Ans.: C, D, E

-Smoking should not occur around any building opening that could allow the smoke to enter the building.

---

10:

Ans.: C

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11:

Ans.: D

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12:

Ans.: C

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13:

Ans.: B

-Part of green cleaning involves including the custodians in the integrative process to get their input and to work together to create goals and procedures for reducing indoor contaminants from cleaning chemicals.

---

14:

Ans.: D

-Window shades that occupants can adjust manually or automatically help reduce brightness and glare.

-Operable windows help with natural ventilation.

15:

Ans.: A

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16:

Ans.: B

-Adjustable air diffusers help with ventilation control.
Thermostats help with temperature control. Thermostats can be provided for zones to help refine the temperature for different areas.

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17:

Ans.: A

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18:

Ans.: A

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19:

Ans.: A

-From ASHRAE 55, the six primary factors of thermal comfort are:
Surface temperature
Air temperature
Humidity
Air movement
Metebolic rate
Clothing

The owner, architect, and engineer must work closely together for a successfuly thermal comfort design strategy for occupants.

---

20:

Ans.: B

-Acoustic surfaces such as soft surfaces, building geometry, and duct insulation all help improve the acoustics of a space.

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21:

Ans.: D

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22:

Ans.: A, B

-A typical LEED synergy is daylighting and views. If more light is let in, most likely this is being accomplished through the use of windows. Those same windows can be used to provide occupants with views to the outside.
Low-cube partitions allow more people to have views.
Vision panels are interior windows placed in walls or doors allowing people to see through the wall/door.

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23:

Ans.: A, C, E

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24:

Ans.: A

-LEED entryways should be grills, grates, or mats to help clean people's shoes off as they walk in. This keeps dust/dirt/contaminants out.
The low VOC material is the best choice available.

---

25:

Ans.: D

-This is the only choice that an occupant can actively do: turn on or off task lighting.
Lighting control for occupants helps them see better by controlling the lighting levels in their area. LEED projects should provide individual occupant controls and group controls for shared spaces (like a conference room).

---

26:

Ans.: B

-Installing windows that are appropriate for the climate and that are strategically located is the correct choice. This refers back to the integrative process and discussing the best options.

-Private offices, janitorial rooms, storage closets, etc. should be located near a building's core (center). This maximizes daylighting by not having walls block out lighting.

---

27:

Ans.: A, C, E

-Architectural finishes that include soft surfaces improve acoustics. Fabric-covered walls or acoustic tiles are some examples.

-Air flowing through the HVAC system can make loud whistling and whooshing noises. Duct insulation reduces the noise of the air flow.

-The geometry of the space is critical to good acoustics. Consider a concert hall - are the acoustics good or bad? Probably good because of the effort put into the geometry of the space. There are

designs that improve acoustics (like a concert hall) and designs that make for poor acoustics (such as high ceilings in a classroom).

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28:

Ans.: A, D

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29:

Ans.: A, B

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30:

Ans.: A, D

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31:

Ans.: A, E

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32:

Ans.: A

- Because the plan is for an entire floor of a building, different areas of the project will receive different levels of lighting throughout the day. To make sure all occupants have quality lighting, a zoned system that adjusts lighting levels based on the quantity of daylight coming in will work best. People in darker areas would have more artificial light, while those in the sunnier areas would have less.

---

33:

Ans.: B

-Demand-control ventilation is based on monitoring spaces and only increasing the ventilation when set points are reached. This is based on having CO2 sensors/monitors in the room. For example, if a room has five people in it and then ten more come in, the CO2 in the air would go up. The sensor would register this and increase the airflow. If the ventilation is only increased as needed, the operating costs go down instead of the system running at a maximum at all times.

---

34:

Ans.: A

-Air intakes should be located near fresh air sources and away from exhaust or smoking areas.

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35:

Ans.: A, B

-IPM is 'a method of pest management that protects human health and the surrounding environment and improves economic returns through the most effective, least-risk option.' - USGBC
IPM can help by choosing the best ways to handle pests by first addressing underlying causes of the problem rather than treating problems after they occur. An example would be taking steps to keep pests out of the building envelope before they find a way in.
IPM avoids over application and only using appropriate chemicals to save on costs.

---

36:

Ans.: D

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37:

Ans.: C

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38:

Ans.: D

-A survey will provide facility managers with information on areas of the building that may be underperforming.

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39:

Ans.: B

-Frosted glass would block the views to the outside.

---

40:

Ans.: B, D

-The general contractor has a role in indoor air quality during construction. They should:
Keep the site free of dust and dirt (inside)
Protect building materials from moisture damage (rain/snow) to prevent mold growth
Cap and seal mechanical ducts so dust does not enter the ventilation system
Prevent smoking in and around the building

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41:

Ans.: D

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42:

Ans.: C

-Acoustics are often overlooked, but they should be considered early in the design process when designing room layouts in order to select a room design that aids this element.

-Entryway systems are part of the design of linking the outside to the inside of the building, not room layouts.

-ETS control is considered in relation to the exterior of the building, not room layouts.

---

43:

Ans.: A

-Operable windows allow users near those windows to control their environment.

---

44:

Ans.: D

-In LEED, occupant surveys are required for some credits. However, merely doing a survey doesn't earn the credit - action must be taken on the survey results. The facility manager is usually responsible for performing corrective actions.
For example, if many occupants complain about an area being too hot or too cold, to improve the occupants health and productivity (improve the triple bottom line) that area needs to have the temperature adjusted.

---

45:

Ans.: D

-VOCs are 'substances that vaporize at room temperature and can cause health problems. VOCs off-gas from many materials, including adhesives, sealants, paints, carpets, and particle board.' - USGBC
While the smell may sometimes be good (New car smell is an example of a VOC) what is inhaled is not actually good or healthy for individuals.
By eliminating/reducing VOCs and their off-gassing, the health of those working with the materials and being around the materials is improved.

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46:

Ans.: A, D

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47:

Ans.: A, B, D

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48:

Ans.: C

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49:

Ans.: B, D

-Natural may be worse because the poor outside air would be coming into the building unfiltered.

-Walk-off mats help capture dust, dirt, and contaminants people could otherwise track into the building.

---

50:

Ans.: C

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51:

Ans.: C

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52:

Ans.: A

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53:

Ans.: B, C, D

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54:

Ans.: B

-A flush-out runs the mechanical systems with 100% outside air to remove contaminants. Flush-outs are usually done after construction is complete and prior occupants moving in.

---

55:

Ans.: D

-IPM begins with monitoring and baiting to reduce the need for chemical pesticides.

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56:

Ans.: D

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57:

Ans.: D

-The design of the building envelope (including the glazing) impacts the energy demand of the building. While more glazing (windows) increases daylighting, the heat gain from allowing more light in may increase HVAC loads. Double-pane glazing is a better insulator than single-pane glazing.

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58:

Ans.: C, D, E

-LEED entryways should be grills, grates, or mats to help clean people's shoes off as they walk in. This keeps dust/dirt/contaminants out.

59:

Ans.: D

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60:

Ans.: B

-Ergonomic furniture and workstations are a way to improve occupant comfort.

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61:

Ans.: B

-This is a prerequisite and is required for LEED certification.

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